

PB-245 751

PROFESSIONAL APPRAISERS' JUDGEMENT OF THE EFFECT
OF AIR POLLUTION ON PROPERTY VALUES

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Prepared for:

Public Health Service

January 1969

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The research upon which this publication is based
was performed pursuant to Contract No. PH 86 -
67 -44 -Neg. 5 with the Public Health Service Depart-
ment of Health, Education and Welfare

Final
Report

Professional Appraisers' Judgment of the
Effect of Air Pollution on Property Values

January 1969

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1

Professional Appraisers' Judgment of the Effect of Air Pollution on Property Values

The present study is the second in a series of studies to be undertaken by the Social Psychology Laboratory on psychological reactions to the environment. In an earlier study,¹ an investigation was made to determine psychological factors which underlie a willingness to work against high odds to reduce water pollution. The work of the Social Psychology Laboratory is differentiated from that of survey services by its specialization in the creation of experimental contexts within which to elicit the responses of subjects. It is our intention in this study to obtain responses from a small group of professional appraisers relating to the reduction in property values due to air pollution. In this sense, we attempt to do through an experiment what might be done by a field study comparing the market value of equivalent properties in polluted and non-polluted areas.²

Starting with an unstructured request to consider alternate ways to assess the cost of air pollution, we considered various alternatives before we

¹William Bezdek, Donald Goldhamer and Fred L. Strodbeck, "Personal Efficacy, Problem Severity and Willingness to Act to Reduce Water Pollution," in Attitudes Toward Water, An Interdisciplinary Exploration, Social Psychology Laboratory, University of Chicago (Prepublication Draft, December 1966).

²See Ronald G. Ridker, "Economic Costs of Air Pollution," reported in Interstate Air Pollution Study, Phase II Project Report, Vol. VI, Effects of Air Pollution, (Cincinnati: U.S. Department of Health, Education and Welfare, 1966).

made the decision to use professional appraisers and, once this decision was made, we designed our stimulus materials. The objective was to carry an approach previously used mainly within our laboratories into a field situation. It was necessary first to get into the offices of appraisers and then to motivate them to participate in our routine. We found that our subjects were most comfortable when we organized our interview around a recording which portrayed an apprentice appraiser reporting to his supervisor. We asked our subjects, the appraisers, to comment on the property value determinations made by the apprentice and his supervisor.

The great advantage of our experimental approach is that it makes it possible to describe one suburban residence where air pollution is present and another where it is absent with a greater constancy of surrounding conditions than is ordinarily attainable in field situations. In addition, by superimposing an overlay of balanced alternate treatments, it becomes possible, or perhaps one should say "hypothetically" possible, to answer a number of additional questions. We cannot be too exuberant about our research as a paradigm of design excellence for later in this report we shall have to confess that one factor became confounded, rather than balanced, and thereby greatly complicated our analysis.

Psychological and Economic Aspects of Air Pollution

The problem of evaluating the economic consequences of environmental quality has many facets, and it is important that readers of this report view it as a methodological exercise by persons who are not specialists in the substantive area of concern. It is our understanding that there are many classes of

psychological problems involved. For example, if air pollution gradually obscures the aesthetic view of a mountain, residents of the area may persist in the belief that they can still see the mountain from their home simply because they could at one time and can now after an unusual rainfall. For some, repainting a discolored house may be considered exclusively as a component of maintaining a life style by conserving what one has. Repainting then is not defined as an expense attributable to air pollution. For others, the movement to a new area which confers an increment in social status makes them less conscious of the way in which air quality led to the deterioration of their old area.

When residents in different areas of a city are surveyed, it is usually assumed that such motivational factors relevant to the competition for a good location are randomized. The social psychological fact is that such factors are never randomly distributed in a human community. It is true that the market price reflects a collectively determined value, and it is also true that economic analysis can proceed despite the loss in specification of motive that accompanies translation into dollar value. Recently, however, environmental qualities—goods which are not commonly bought and sold, such as air, water, and noise—have attracted attention. This suggests that an effort should be made to incorporate into the decision matrix some of the information which would otherwise be lost by transformation to dollar market values alone.

Sources of pollution are ordinarily sources of income in a community. Typically, low cost industrial processes permit pollutants to escape; if the pollutants were controlled at their origin the cost of manufacturing would be increased. A given manufacturer, say a pulp mill operator, may not have a

sufficiently great margin of profit to enable him to control pollutants and continue to operate. Some air pollution control efforts produce byproducts that pay for themselves, but this is not typical. Hence, air pollution may be perceived as an alternative to unemployment in the community.³

In general, the objective of air pollution control policy is to employ government intervention to achieve a level of pollution below which the cost of further reduction would exceed the benefits. To do this local governments need an estimate of the value of various degrees of pollution control. This need may arise in areas where data for a standard economic survey are not easily available, or it may be desirable to use hypothetical fact situations for which field data do not exist. If the reliability and validity of the techniques we employ can be established in environmental study as they have in other institutional contexts, it is believed that they may be particularly applicable to planning situations which must be evaluated in the absence of field data.

Our study may be contrasted to the economic analysis of the cost of air pollution made in St. Louis by Ronald G. Ridker. He used air quality data from the Interstate Air Pollution Study and data on property values from census tracts comprised predominantly of single family homes. Ridker found that air quality was more important than school quality, travel time from the central business district and state location, but less important than accessibility of highways. Applied to the whole St. Louis area, his technique yielded an estimate that the value of a single family dwelling increased from \$83.00 to

³ For a discussion of a positive correlation between tolerance for a nuisance and positive evaluation of the source of that nuisance, see Community Reactions to Air Force Noise, National Opinion Research Center, Chicago. (Ohio: Wright-Patterson Air Force Base, 1961.)

\$245 per dwelling with each decrease of 0.25 milligrams of SO_3 per 100 square centimeters of air per day. The effect of improving air quality on the entire housing market was difficult to estimate but it appears that there was a potential appreciation of between one and three hundred million dollars which might be realized by the cessation of air pollution. Ridker's conclusion as to the economic importance of air pollution is buttressed by an additional study, done in St. Louis, using a control area and an exposed area before and after air pollution. In three years, there was a loss of more than ten percent in property values in the contaminated area.⁴

The existence of the Ridker results is helpful in two ways. First, it gives us a rough expectation as to the magnitude of effect we can expect; and second, it provides a clear example of the need to generalize cost experience beyond those few localities for which data of the type he employed are available.

The Strategy of Using Appraisers

In reasoning "If air quality is a factor in the determination of property values then the professional training and experience of appraisers should enable them to assess its effects reliably," one is betting on an unstated belief that an appraiser's success depends upon the accuracy with which he estimates the value of property. Real Estate Appraisers were quick to correct what they believe to be a false lay impression that they determine real estate prices. Their particular expertise, they explain, is in estimating or reflecting property values under conditions for reasonable bargaining and, in any single sale, the actual price is determined by the willingness and ability of a seller to sell and a buyer

⁴Ridker, "Economic Costs of Air Pollution."

to buy.

In arriving at an estimate of current property value, it is reported that appraisers rely on two major principles: (1) the replacement cost approach -- the value of the land plus the price for labor and materials applicable if the house in question were to be built again today, and (2) the market approach. It is with regard to this second principle that the appraiser's training and experience in a community are most evident. It is ordinarily necessary for him to attempt to find three nearby properties which have recently been sold and are sufficiently similar to the property under consideration that their average sale price can serve as an index of market value. In practice, of course, one rarely, if ever, finds three houses that are identical in location, structure, age, time of sale, etc. to the one under consideration. Since similar, but non-identical, comparison properties differ in a number of ways, it is the appraiser's job to identify those differences which affect market value and distinguish them from those which do not. In this operation, he proceeds by "deliberate judgment" rather than by clear rule.

For instance, a particular buyer may prefer a white house to a blue house; the appraiser himself may prefer white to blue; however, unless the appraiser detects a systematic preference for white in the total population of buyers along with a concomitant readiness to pay more for white houses, he will not let color affect his judgment in arriving at an estimate of value. So with air pollution; it may be noticeable; an individual buyer may be sensitive to it; the appraiser himself may consider it undesirable. Nevertheless, if in the appraiser's judgment, based on past transactions, it has no systematic effect on price, it is irrelevant to the appraisal. In a very real sense the appraiser's competence

and professional standing are based on a continual refinement of his ability to distinguish the relevant from the irrelevant in accounting for differences in sale prices of comparable properties. This inquiry then is directed to the determination of the degree to which the appraiser's market experience enables him to set a dollar value on air quality.

Although appraising is their professional calling, one would not expect appraisers as subjects in an experiment to be immune to developing an unnaturally heightened consciousness of air quality if it were presented as the primary concern of the investigators. To avoid a bald expression of our research interest it was thought best to imbed air pollution in a complex of factors. This was done by having the subject appraiser give attention to the quality of a teaching situation -- the recorded conversation between the apprentice appraiser and his subject -- and by including many other details in that conversation. While he listened to a recorded report by the apprentice the subject held in his hand a snapshot of the house and an appraisal form. The house had a fictitious address in an imaginary town called Zenith. The appraisal form gave detailed information about the house, site and neighborhood. Replacement cost, depreciation and market data were shown on the back of the form. There was no controversy over the facts, for only the apprentice had seen the house. Thus, our subjects were given an unconflicting, "on-the-site" report, and the problem for them became restricted to commenting on the judgment of a person with less training in the profession. Even in those versions where the supervisor differs with the apprentice the issues are not sharply joined. The dissent is much less sharp than if there had been a dispute between fully qualified appraisers in, say, a condemnation case.

The Sample

The subjects were all members of the Chicago Chapter of the Society of Real Estate Appraisers. Membership in the Society is limited to appraisers with at least five years' experience who pass an appraisal examination and demonstrate their ability with a narrative appraisal report. The sample was drawn from a listing of the members of the Society, excluding officers of the Society and one appraiser used in a pre-test. From the 181 members about one-third were selected at random to participate in the study. When this list was submitted to the Board of Directors of the Society for approval, the Directors, for various reasons, removed eight appraisers from the list. In addition, six appraisers were "too busy" to be interviewed, four had moved, three were ill, and one retired. As non-responses were encountered, they were replaced by alternates, and in some case, alternates, themselves, were also replaced -- in all, there were 14 randomly selected replacements.

The initial approach to an appraiser in the sample was a letter from the President of the Society of Real Estate Appraisers, urging full cooperation with the Director of the Social Psychology Laboratory of The University of Chicago and his assistants in a "study of apprenticeship training in our profession." A few days later a letter from the project director was sent explaining that one of our interviewers, Mr. Heberlein or Mr. Haller, would call to arrange an interview within a few days about the "science -- or is it

the art?" of appraising and training apprentices to appraise. Thus prepared, the appraisers were generally cooperative when asked to schedule an interview even though it was a busy time of year for them. At the end of the interview, the subjects were asked not to comment on our interest in air pollution until our report had been released. In most cases, the interviewees then participated in a wide-ranging discussion of the problems of the profession.

The Design of the Experiment

It was our feeling that our young interviewers, talking with an experienced appraiser in his office, set a context which was, to a degree, replicated by the apprentice talking with his supervisor in the recording. One cannot be sure with whom a subject identifies in a recording, but there was a strong presumption that the subject would identify with the supervisor. If this is true, then when the supervisor supports the apprentice's judgment, the apprentice's position will be more persuasive. On the other hand, when the supervisor differs from the apprentice, this difference should constitute an attractive alternative if the subject chooses to follow it. By having the apprentice both change and not change his estimate in response to air pollution, and having this take place under conditions in which the supervisors agree and disagree with this estimate, we believe we have created a range of situations in which the subject can perform realistically and feel comfortable about his decision. We had hoped to estimate what might be considered the "true" position for sets of subjects by controlling statistically the effects of the counter-balanced information.

It was our intention to proceed with a straightforward $2 \times 2 \times 2$ factorial design. Post-experimental information, however, caused us to question that

our data were suitable for such analysis. For this reason, we use the unbalanced arrangement shown in Table 1 to make a first description of the allocation of the 48 subjects by treatment.

The Four Versions and Their Results

Table 1 will guide our exposition of results. The first case we consider is the one in which the apprentice and the supervisor agree that air quality has no effect on their estimates of property value. The text for this treatment condition is given below.

TABLE 1

EFFECT OF AIR QUALITY ON ESTIMATES OF PROPERTY
VALUE UNDER 8 EXPERIMENTAL CONDITIONS

Air Quality	Effect of Air Quality on Apprentice's Estimate of Property Value	Supervisor's Reaction to Apprentice's Estimate
Pure	Not Affected	Approves Disapproves
	Raised	Approves Disapproves
Polluted	Not Affected	Approves Disapproves
	Lowered	Approves Disapproves

Apprentice's Estimate Not Affected, Supervisor Approves

John Jones: Well, Mr. Smith, I went out and looked at that colonial on First Street yesterday. You have the appraisal sheet I made up.

Mr. Smith: Yes, John, I've looked at your appraisal. Why don't you explain the basis for your judgments to me; then I'll make a few comments which might be helpful to you.

John Jones: That's fine, sir. The house was in a good neighborhood here in Zenith. As you can see, it was near all the major facilities and not too far from downtown. It wasn't too near any industrial area, expressways, or anything that could be detrimental to the neighborhood. The neighborhood itself seems to me to be quite stable. I suspect that it has a remaining economic life of more than twenty years, although this may be conservative. It's an upper middle-class area with income well above the average.

The lot was deeper than usual--190 feet to be exact. The alley was unpaved but it's not used a great deal since all the houses have front driveways. There are no easements.

There was a good foundation. The basement was pretty deep, about eight feet. I checked for water marks when I was down there, but there weren't any. I checked with the owner and he said that it had never flooded. I think this is because it's near the top of a hill. Also, in the basement I noticed that the rafters were 2 x 12's --a little better than normal--a sign that the house was pretty well

constructed. That was my general impression, too--that the house was well built. The outside walls are painted brick. The whole exterior had a clean appearance.

[AT THIS POINT THERE IS A DIFFERENCE BETWEEN THE REPORTS WHERE AIR IS POLLUTED AND WHERE IT IS PURE.]

AIR POLLUTED

"It had just been painted. I was surprised at the cleanliness because all of the buildings around it were really covered with soot. The owner said this is a real problem. He has to paint every three years. Dirt and dust in the air mess up everything."

AIR PURE

"I was surprised at the cleanliness. Where I live we have a real problem with dust and dirt in the air. I guess this is one of the few areas left here in the city where this isn't the case."

[THE TEXT BELOW IS AGAIN THE SAME FOR BOTH EXPERIMENTAL VERSIONS.]

The roofing is nearly new--seven years, I think. I thought for a while that it was leaking since there were water stains on the wall in an upstairs bedroom. But then I noticed that it was the children's room and there was a giant vaporizer there. I asked the owner if this had been used. He said the kids had been sick and it had been on almost continuously the last couple of weeks. The water spots looked pretty fresh and I didn't see any elsewhere. The owner verified this and showed me a receipt for the new roof. He said that it hadn't leaked, at least so far as he knew.

One of the big problems with design is the garage. It's too small for a big car. This could probably be fixed up with a small wooden extension, but as it stands now you couldn't shut the door with a Cadillac in there. As you can see on the sheet, there is an

attached 12 x 15 screened porch. The interior is consistently decorated in an early American motif. The floors are oak and are carpeted downstairs. There is gas heating with central air conditioning and they have a new hot water heater.

One thing that was a little unusual, Mr. Jones, was the electrical system. The house had just been rewired and had a 200 amp. system with 18 circuits. This, I think, is not common. The owner didn't have any special equipment drawing this much current. I asked him why this system was installed. He told me he was just planning for the future.

The bath and fixtures were all the original age of the home-- in good condition, but slightly dated. The kitchen was fifteen years old with wood cabinets, a Kitchen Aid dishwasher, a Disposall, and an exhaust fan. It was in good condition. The only omission might be a built-in oven and range.

The floor plan of the house was excellent. It was circular-- I mean a sort of flow from the entrance hall to living room, dining room and kitchen. There was a sort of back hall which led to the dining room and kitchen. The only problem with the floor plan is the location of the stairs leading to the basement and second floor. Aesthetically they were okay, but it would be very difficult to move furniture up and down; they had sharp turns at the top of both stairs. Somehow they got a large freezer to the basement and a triple dresser upstairs, so I guess it isn't any great problem.

There was only physical depreciation--just normal wear and tear. There weren't any exceptional functional obsolescences. There were enough closets and so on. Perhaps the garage would come in here but I didn't think it was really important enough. Also, there were no detrimental environmental economic effects, like road noise, airplane traffic, or industry near. In general, it was just a good, quiet neighborhood. So, since the house was in good condition, clean, and so forth, and the kitchen, porch, wiring and roof were pretty new, I estimated the effective age as twenty-years.

Mr. Smith: That's fine, John; now what about your judgements concerning value here on the back of the sheet?

John Jones: Yes sir, that's where I had a lot of difficulty.

First, as usual, I used the cost approach. There were 52 front feet at \$225.00 per foot. Site improvements were just "as is;" I figured \$500.00 top. Then I computed the square feet of the house. So I went to the new manual on property values here in Zenith. A cost for a similar home with 2400 square feet was \$13.50--that's \$13.50 per foot. However, this manual is based on a part of the city where costs are ten percent higher than here. But since this manual came out labor rates have gone up six percent. So (and I hope that is okay) I reduced the--this factor by four percent. And I did likewise for the porches and garage. The effective age I estimated at twenty years, based on my examination of the property. I figured depreciation here to be roughly two percent a year--a little higher for the porch which, being open, is

subject to more wear and tear. There is also some functional obsolescence for the garage -- I think about ten percent since it would cost something to put an extension on it. Calculating these, I came to about \$32,000 by the cost approach.

On the market approach, I compared three houses at the location you see listed above. They were all comparable colonials in the city. House A was smaller and lacked a garage and a porch, thus the twenty-two hundred dollars added to this sale price. House B had a new bath and kitchen while the house being investigated did not. House C had a new kitchen as well as bathrooms. There doesn't seem to be much difference between these houses but there is a \$2,000 discrepancy in the market value.⁵ It's hard to figure out. The neighborhoods are similar -- away from industry, near facilities, and so on. There is only one thing I can pin it down to. I was over to look at the house on Adams Road [OR UNDER TREATMENT CONDITION WHEN AIR IS PURE, "I was over to look at the house on Third Street and Adams Road"] the other day and the houses were all filthy on the outside

⁵ [The sale value of the three comparison houses is recorded on the second side of the appraisal form, which the subjects held at all times.]

<u>Air Polluted</u>		<u>Air Pure</u>	
A 2222 Second Street	\$32,200	A 2222 Second Street	\$34,200
B 3333 Third Street	\$32,000	B 3333 Third Street	\$32,000
C 4444 Adams Road	\$30,000	C 4444 Adams Road	\$32,000
Indicated value		Indicated value	
from cost approach	\$32,000	from cost approach	\$32,000

--a lot of peeling paint and there is a real stench in the air. I don't have any idea where this is coming from because I know there is no industry near. Must be funny wind currents. Anyway, I guess this must be why the property is valued so low.

AIR POLLUTED

[i.e., the \$30,000 house on Adams Road, C]

"While the property under consideration is not in this area, it is in a similar area. I mean all the neighboring houses are really filthy and there sure are noxious odors around.

But there still isn't really a marketable item. I mean it just isn't worth several thousand dollars to a prospective buyer. So I didn't lower the value to \$30,000 as I might have. Thus my correlated final estimate of the market value is \$32,000.

AIR PURE

[i.e., the \$32,000 house on Third, B, and the \$32,000 house on Adams Road, C]

"Since the property under consideration is not in this area it should be valued at more than properties B and C.

Yet, I didn't feel justified in raising its value above the replacement cost and the market value just because the air was clean in the neighborhood. Thus my correlated final estimate of the market value is \$32,000.

[THE FOLLOWING IS COMMON TO BOTH TREATMENTS].

Mr. Smith: Well, I think you made a pretty good appraisal, John--especially since it was one of your first times out. One thing you really have a knack for is spotting some of these pretty subtle things, like the water marks on the kids' room. It's this sort of indication that really gives you a lot of information. This class of house, you really don't have to worry too much about. But, don't get me wrong; it's still good to have a sharp eye.

Your assessment of the neighborhood was okay. I think out there on First Street the minimum income is a little higher than you listed it but I may be wrong. Anyway, it's of no great consequence. Generally, it's a pretty stable neighborhood.

You spotted the electrical system--that's something that's easy to miss. Eighteen circuits is a lot. But you'll be running across more and more of this sort of thing these days. Builders, as well as owners, are concerned with the potential increase in electrical use.

So, John, I'd say your assessment of the neighborhood site and building are not bad. I'm not too familiar with that particular house but it seems to me that you might have figured the effective age a little low; but, again, that's a matter of judgment and opinion --and you'll gain that with time.

Now your assessment by the cost approach; this was pretty good too. I checked your calculations on area and you didn't make any arithmetical mistakes. I guess you discounted about, let me see, ah--about ten percent for the second story. Fine. The unit cost is about right. Maybe a little high. I think building costs have only gone up five percent, but that's no big problem. I mentioned that the effective age may be a little low, but the physical depreciation of 40 percent is good; two percent is a pretty good rule of thumb, but this again, John, is something you'll learn. Fifty percent may be high for the porch, especially since you estimated the effective age at twenty years. I'm glad you spotted the functional depreciation on the garage. Ten percent was a pretty good estimate for that, since it does take away from the value of the house.

On the market approach, John, you really should try to get three houses in the same area. Now I realize it's pretty difficult and can't always be done. But it would have saved you some frustration, especially in this case. But you can't always do it. I'm familiar with these particular three since this office appraised them. Your figures and explanations are correct. The neighborhoods are very similar. Just over on Adams there is a problem with soot and odor, although there is no industry or freeway nearby. It seems to me, John, that your problem was reconciling the differences in the selling prices of your comparison properties in the light of the \$32,000 arrived at by the cost approach.

AIR POLLUTED

"I think you handled the situation very well, John. Polluted air is, uh--pretty common here in Zenith but just because a house is in an area which has soot and odor you shouldn't lower the value just because of that. This factor may have been present in the low selling price on Adams Street, but you can't tell. It's one of those things that just doesn't work in the market situation. Anyway, John, I think you did the right thing in not lowering the value just because the property was in a polluted area.

Generally, John, you did a good job here. I think we'll make a first rate appraiser out of you yet."

AIR PURE

"I think you handled the situation very well, John. Polluted air is pretty common here in Zenith but just because a house is in an area which is free from soot and odor, uh--you shouldn't raise the value above the replacement cost. This factor may have been present on the Second Street property but you can't tell. It's one of those things which just don't work in a market situation. Anyway, John, I think you did the right thing in not raising the value just because this property was not in a polluted area.

Generally, you did a good job here. I think we'll make a first rate appraiser out of you yet."

Immediately after listening to the stimulus tapes the subjects were asked the following two questions:

MINIMUM VALUE

If the owner of this house were a friend of yours--and given the conditions for reasonable bargaining--what do you think, to the nearest hundred, is the minimum amount the owner should accept for this house? To avoid the problem of commission imagine that the house was being sold directly to another buyer.

MAXIMUM VALUE What do you think is the maximum amount, again in hundreds, that he could expect to get from the direct sale of his house?

Six appraisers heard one experimental treatment in which air was polluted and six heard another where air was pure. Results are shown in Table 2. When air is polluted it appears that there is a systematic disposition to reduce the minimum value by \$1,800. The significance level shown

TABLE 2

SUBJECTS' APPRAISALS WHEN NEITHER APPRENTICE NOR HIS SUPERVISOR PERMIT AIR QUALITY TO AFFECT ESTIMATE OF VALUE (\$'000's)

Air Quality	Minimum Estimate of Value	Maximum Estimate of Value	Mean Estimate of Value
Polluted	30.0	32.0	31.0
	32.0	32.0	32.0
	30.0	35.0	32.5
	30.0	35.0	32.5
	30.0	33.0	31.5
	30.0	32.0	31.0
Mean	30.3	33.2	31.8
Pure	32.0	34.0	33.0
	34.0	36.0	35.0
	32.0	34.0	33.0
	32.0	34.0	33.0
	30.0	35.0	32.5
	32.5	33.0	32.8
Mean	32.1	34.3	33.2
Difference	1.8	1.1	1.4
SIGNIFICANCE	.002	(n.s. .10)	.02

in the first column of Table 2 indicates that the hypothesis that the two sets of minimum values were from the same population can be rejected at the .002 level

by the Mann-Whitney U Test.⁶ In other words, we are secure in assuming that the mean difference in value is statistically significant. The maximum sale prices are not significantly differentiated though the average difference is \$1,100. The mean sale prices, that is, the averages of the minimum and maximum, are different by \$1,400 which is significant at the .02 level.

From the perspective of our assessment of the experiment, however, we are not free to say that air pollution results in approximately a four percent reduction in property value (\$1,400 divided by \$32,000) because one of the components of the presentation, added to give plausibility to the experiment, is unfortunately confounded with the result. This can be noted in the variation of the corrected sale prices for the comparison houses appearing on the appraisal sheet which the subject was given, represented in Table 3.

TABLE 3

COST INFORMATION SUMMARY (\$'000's)

Air Quality	Corrected Sale Price of Comparison Houses			Average Corrected Sale Price = Mar- ket Value	Value by Cost Approach
	A	B	C		
Polluted	32.2	32	30	31.40	32
Pure	34.2	32	32	32.73	32

The variation in the price of houses A, B and C provided a tangible reason for the apprentice to hesitate before he made his final correlated estimate of value. The subject appraisers, having the same information on their data sheet, might have computed the 31.4 figure in the polluted condition and used this as a basis

⁶Sidney Siegel, *Nonparametric Statistics*, (McGraw Hill Book Company, Inc., New York, 1956), pp. 116-127.

for estimating property value rather than using the 32.0 figure which was recorded, inaccurately, on the data sheet. Thus their estimates of value might be expected to be lower than 32.0 by 0.6 thousand dollars ($32.0 - 31.4$), not because of polluted air but simply because of a more accurate determination of market value. Therefore if we are to demonstrate an effect due to air pollution we must find a significant number of estimates below 31.4. A similar argument can be made for the inaccurate reporting of the average market value for the houses in the pure air condition. In this case we would have to find a significant number of appraiser's estimates above the 32.7 figure rather than above 32.0. This possible bias in our results can be corrected if we add 0.6 to each estimate in the polluted air condition, thus bringing the estimates up to the expected 32.0 figure, and by subtracting 0.7 from each estimate in the pure air condition, thus bringing them down to the expected 32.0 figure. Corrected results are shown in Table 4.

TABLE 4
 SUBJECTS' MEAN ESTIMATES (SEE TABLE 2)
 CORRECTED FOR AVERAGE MARKET VALUE
 (\$'000's)

Air Quality	Minimum Estimate of Value	Correction for Average Market Value	Corrected Mean Estimate of Value
Polluted	31.0	+ 0.6	31.6
	32.0		32.6
	32.5		33.1
	32.5		33.1
	31.5		32.1
	31.0		31.6
Mean	31.8		32.4
Pure	33.0	- 0.7	32.3
	35.0		34.3
	33.0		32.3
	33.0		32.3
	32.5		31.8
	32.8		32.1
Mean	33.2		32.5
Difference	--		0.1
SIGNIFICANCE			(n.s. .41)

This is patently too much of a correction to make, because it gives no weight to the \$32,000 obtained by the cost approach. Since the \$32,000 was given the additional salience of being the final correlated estimate of the apprentice, and this estimate was affirmed by the supervisor, it undoubtedly contributed to the subjects' decisions. The

essential confounding is with us, however, and in the discussion of this and other variations, we will have to be cautious. Even using the most conservative position, there are some significant effects. Hence, it is our decision to report our results in both forms: without and with full correction for average sale price.

There is collateral evidence from our questionnaire which may also be considered. For example, all six of the subjects said both the apprentice and his supervisor handled air quality poorly when the air was pure and there was no increase in their final correlated estimate. On the other side, five of six faulted the apprentice, and three of five the supervisor, when no reduction was made when air was polluted. Viewed in terms of the question: "Should air pollution make a difference?" twenty out of 23 responses of the twelve subjects can be interpreted to answer: "Yes, it should." This, then, lends greater credence to the interpretation before correction in Table 2 than to the "no effect" interpretation suggested by Table 4.

Following are representative comments:

(Air polluted.) Well, in his interview he said that this building (Property C) had similar characteristics to the one being appraised, as far as the air pollution. Despite what he and his employer said, that there is no reaction, obviously there must be or there is no other reason for this building selling as low as it did. I think there should be some weight given to Sale C.

(Air pure.) Basically, the main difference, assuming the correctness of the market data, is that this house is in a clean area. That's worth between five and ten percent, particularly in a community where there is very little clean air.

Apprentice's Estimate Not Affected, Supervisor Disapproves

In this treatment there is a conflict between the apprentice and his supervisor and we assume that this frees a respondent to follow either course. To

effect this variation, the recording is changed so that in place of the supervisor's supportive assent, as shown on the inset lines of page 18, we now have the following:

AIR POLLUTED

"I don't think you handled the situation very well, John. Polluted air is pretty common here in Zenith. A house in an area where there is soot and odor is not worth as much as one that isn't. That's all there is to it. The cost approach is only a guide. John, your correlated final estimate should have been \$30,000. You should have lowered the value because the property was in a polluted area.

You did a good job of observing the house but your estimate was in error. But don't worry; experience will cure that. I think we'll make a first rate appraiser out of you yet."

AIR PURE

"I don't think you handled the situation very well, John. Polluted air is pretty common here in Zenith. A house in an area which is free from soot and odor is worth more than one that isn't. That's all there is to it. The cost approach is only a guide. John, your correlated estimate should have been \$34,000. You should have raised the value because the property was not in a polluted area.

You did a good job of observing the house but your estimate was in error. Don't worry; experience will cure that. I think we'll make a first rate appraiser out of you yet."

The responses of the twelve appraisers hearing these two treatments (six in each) appear in Table 5 and bear out our expectations. The air quality contrast plus the dissenting opinion of the supervisor significantly affects the uncorrected estimate of the value of the property -- the difference is \$2,100. The difference is not quite significant ($P = 0.07$ rather than 0.05) when the correction for the average sale price is made in Table 6, but even after some correction a sizable difference of \$800 remains.

In this, as in the previous contrast, the apprentice did not change his final estimate. When asked directly whether they agreed with his estimate (of \$32,000), seven of the twelve subjects in this variation disagreed. All seven mentioned air pollution or the market data to explain their disagreement, but only two of the seven referred explicitly to the supervisor's disagreement. Representative comments:

(Air polluted.) . . . I think he's a little low on his economic obsolescence . . . this matter of air pollution. . . borne out, of course, by his market approach. This property in the same area sold for less.

(Air pure.) . . . I would probably rely on the market approach more than I would on the cost approach here.

(Air pure.) . . . The fact that he took the market data from another area, an area that wasn't as desirable from the standpoint of air pollution, and he didn't make any allowance for it. The market data [which] was in the immediate area . . . indicated the other [value].

These comments suggest that the market approach was the primary reason for our subjects' disagreement, but as we will see later, the cost approach was frequently used to justify disagreement when the apprentice's estimate is affected by air pollution. Thus reasons for disagreement vary with the treatment conditions.

TABLE 5

SUBJECT'S APPRAISALS WHEN APPRENTICE DOES NOT PERMIT
AIR QUALITY TO AFFECT ESTIMATE OF VALUE AND THE
SUPERVISOR DISAPPROVES

(\$'000's)

Air Quality	Minimum Estimate of Value	Maximum Estimate of Value	Mean Estimate of Value
Polluted	30.0	32.5	31.2
	32.0	34.0	33.0
	30.0	32.0	31.0
	32.0	32.2	32.1
	30.0	32.5	31.2
	30.0	32.0	31.0
Mean	30.7	32.5	31.6
Pure	32.5	33.5	33.0
	33.0	34.5	33.8
	32.0	34.5	33.2
	32.0	35.0	33.5
	34.0	37.4	35.7
	32.0	34.0	33.0
Mean	32.6	34.8	33.7
Difference	1.9	2.3	2.1
SIGNIFICANCE	.003	.003	.002

TABLE 6
 SUBJECTS' MEAN ESTIMATES (SEE TABLE 5)
 CORRECTED FOR AVERAGE MARKET VALUE
 (\$'000's)

Air Quality	Mean Estimate of Value	Correction for Average Market Value	Corrected Mean Estimate of Value
Polluted	31.2	+ 0.6	31.8
	33.0		33.6
	31.0		31.6
	32.1		32.7
	31.2		31.8
	31.0		31.6
Mean	31.6		32.2
Pure	33.0	- 0.7	32.3
	33.3		33.1
	33.2		32.5
	33.5		32.8
	35.7		35.0
	33.0		32.3
Mean	33.7		33.0
Difference			0.8
SIGNIFICANCE			(n.s. .07)

Apprentice's Estimate Raised or Lowered, Supervisor Approves

In this variation, both the apprentice and his supervisor allow air quality to influence the final correlated estimate. The influence is to raise the estimate when the air is pure and lower it when the air is polluted. This variation is brought about by substituting for the apprentice's evaluative statements, inset on page 16, and his supervisor's assent to those statements, inset on page 18, the following:

APPRENTICE

AIR POLLUTED

'While the property under consideration is not in this area, it is in a similar area. I mean all the neighboring houses are really filthy and there sure are noxious odors around. So in the light of this I felt justified in lowering the value below the \$32,000 arrived at by both the cost and market approaches. [THE JUSTIFICATION FOR A MARKET VALUE OF \$32,000 IS THE OTHER TWO COMPARISON HOUSES.] My final correlated final estimate of the market value is \$30,000.

AIR PURE

'Since the property under consideration is not in this area it should be valued at more than property B and C. The question is how much more should it be valued? It seems a good rule of thumb to use the cost approach value as an upper limit. But this clear air is a marketable commodity. I mean it might cost \$32,000 to build this house anywhere, no matter what the condition of the air. And since it is in a neighborhood where the air is good, like House A, I raised it above the cost and market estimate. My final correlated estimate is \$34,000.

SUPERVISOR

AIR POLLUTED

I think you handled the situation very well, John. Polluted air is pretty common here in Zenith. A house that is in an area where there is soot and odor just isn't worth as much as one that is not. That's all there is to it. The cost approach is, uh — is only a guide. John, you did the right thing lowering the correlated estimate to \$30,000 because this property is in a polluted area.

Generally, you did a good job here. I think we'll make a first rate appraiser out of you yet.

AIR PURE

I think you handled the situation very well, John. Polluted air is pretty common here in Zenith. A house in an area away from soot and odor is worth more than one that isn't. That's all there is to it. The cost approach is only a guide. John, on your correlated estimate you did the right thing raising the value above the market and replacement value to \$34,000 because the property was not in a polluted area.

Generally, John, you did a good job here. I think we'll make a first rate appraiser out of you yet.

The responses of the twelve appraisers hearing these two treatments (six in each) appear in Table 7 and accord with our expectations. The air quality contrast plus the judgments of the apprentice and the supervisor yield an uncorrected difference of \$2,300 in the mean estimate of value, significant at the .001 level. When the correction for the average market value is made in Table 8, the difference remains significant ($p = .02$) and amounts to \$1,000.

TABLE 7

SUBJECTS' APPRAISALS WHEN APPRENTICE RAISES OR
LOWERS ESTIMATE OF VALUE AND SUPERVISOR APPROVES

(\$'000's)

Air Quality	Minimum Estimate of Value	Maximum Estimate of Value	Mean Estimate of Value
Polluted (Apprentice Lowers)	29.0	33.0	31.0
	29.5	31.0	30.2
	30.0	31.5	30.8
	28.5	31.5	30.0
	30.0	30.0	30.0
	27.0	33.0	30.0
Mean	29.6	31.7	30.3
Pure (Apprentice Raises)	32.0	34.0	33.0
	33.0	34.0	33.5
	32.0	34.0	33.0
	31.0	32.5	31.8
	30.0	33.0	31.5
	32.0	34.0	33.0
Mean	31.7	33.6	32.6
Difference	2.7	1.9	2.3
SIGNIFICANCE	.002	.003	.001

TABLE 8

SUBJECTS' MEAN ESTIMATE (SEE TABLE 7)
CORRECTED FOR AVERAGE MARKET VALUE

(\$'000's)

Air Quality	Mean Estimate of Value	Correction for Average Market Value	Corrected Mean Estimate of Value
Polluted (Apprentice Lowers)	31.0	0.6	31.6
	30.2		30.8
	30.8		31.4
	30.0		30.6
	30.0		30.6
	30.0		30.6
Mean	30.3		30.9
Pure (Apprentice Raises)	33.0	- 0.7	32.3
	33.5		32.8
	33.0		32.3
	31.8		31.1
	31.5		30.8
	33.0		32.3
Mean	32.6		31.9
Difference			1.0
SIGNIFICANCE			.02

When asked directly, six of the twelve subjects in this version disagreed with the apprentice's final estimate. One of these increased the allowance for pollution to \$4,000. The other five, to judge from their recorded explanations, had their attention fixed on the \$32,000 figures for cost and for market approaches, which were on the appraisal sheet they were holding. They ignored or neglected the air pollution. Typical comments:

(Air polluted.) I would not accept the final correlated estimate. I would make it \$2,000 higher. If I agreed with the cost and market approach as shown here. It's indicated by both the cost and the market so there would be no reason -- if these were figured correctly there would be no reason to adjust it any lower.

(Air pure.) I would have to go with the cost approach here as an upper limit of value, and his market data is weak. He's evidently out of the neighborhood with his other two houses. Just insufficient market data.

(Air pure.) Two of the three comparables are not really comparable. Two of them are from a different area and -- where there is a problem of obsolescence which is difficult to estimate in dollars.

Apprentice Raises or Lowers Estimate, Supervisor Disapproves

In this variation air quality affects the apprentice's final correlated estimate, but his supervisor disapproves, saying that there should be no effect.

This variation was constructed by changing the preceding version so that the supervisor's comments, instead of agreeing as inset on page 28, are as follows:

SUPERVISOR

AIR POLLUTED

I don't think you handled the situation very well, John. Polluted air is pretty common here in Zenith. Just because a house is in an area where there is soot and odor you shouldn't lower the value. This factor may have been present in the low selling price on Adams Street, but you can't tell. It's

AIR PURE

I don't think you handled the situation very well, John. Polluted air is pretty common here in Zenith but just because a house is in an area which is free from soot and odor you shouldn't raise the value above replacement cost, and the market value. This factor may have been present in the low selling price on Adams

one of those things which doesn't work in a market situation. Anyway, John, I don't think you did the right thing in lowering the value just because the property was in a polluted area.

Generally, you did a good job in observing the house, but your estimate was in error. Don't worry, though, experience will cure that. I think we'll make a first rate appraiser out of you yet.

Street and Third Street but you can't tell. It's one of those things which just doesn't work in a market situation. Anyway, John, I don't think you did the right thing raising the value just because this property was not in a polluted area.

Generally, John, you did a good job of observing the house, but your estimate was in error. Don't worry, experience will cure that. I think we'll make a first rate appraiser out of you yet.

The responses of the twelve appraisers in this version appear in Table 9.

The uncorrected difference is \$1,300 and is significant ($p = 0.004$). But when the correction for the average market value is made, in Table 10, the difference vanishes.

In this variation the supervisor disagreed with the apprentice's final estimate and not one of the twelve subjects agreed with the apprentice (although six of them split the difference). This is a clear demonstration of the lack of influence of the apprentice's judgment on the evaluations given by our subjects.

Typical comments were:

(Air polluted.) I would go along with the fellow that interviewed him. . . . If all these figures are right, it should be \$32,000, the upper limit. I'm not really making it higher; I'm making it at his indicated cost approach.

(Air polluted.) I think he's got a weak market data approach.

(Air pure.) Lower. . . . Substitution utility. No one will normally purchase an item for more than you can get for equal value, equal utility at another location.

When there was a discrepancy between the subjects' and the apprentice's estimate of value, subjects were asked to account for the discrepancy. They did this in one of two ways -- by attacking the apprentice's inadequate use of market data when he failed to raise or lower and attacking his inadequate use of cost

TABLE 9

SUBJECTS' APPRAISALS WHEN APPRENTICE RAISES OR
LOWERS ESTIMATE OF VALUE AND SUPERVISOR DISAPPROVES
(\$'000's)

Air Quality	Minimum Estimate of Value	Maximum Estimate of Value	Mean Estimate of Value
Polluted (Apprentice Lowers)	31.0	32.0	31.5
	31.0	32.0	31.5
	30.0	30.5	30.2
	31.0	33.0	32.0
	32.0	32.0	32.0
	30.0	32.5	31.2
	Mean	32.0	31.4
Pure (Apprentice Raises)	32.0	33.0	32.5
	32.0	34.0	33.0
	32.0	34.0	33.0
	31.0	32.5	31.8
	32.0	33.0	32.5
	32.0	35.0	33.5
	Mean	33.6	32.7
Difference	1.0	1.6	1.3
SIGNIFICANCE	.021	.003	.004

TABLE 10

SUBJECTS' MEAN ESTIMATE (SEE TABLE 9)
CORRECTED FOR AVERAGE MARKET VALUE

(\$'000's)

Air Quality	Mean Estimate of Value	Correction for Average Market Value	Corrected Mean Estimate of Value
Polluted (Apprentice Lowers)	31.5	+ 0.6	32.1
	31.5		32.1
	30.2		30.8
	32.0		32.6
	32.0		32.6
	31.2		31.8
Mean	31.4		32.0
Pure (Apprentice Raises)	32.5	- 0.7	31.8
	33.0		32.3
	33.0		32.3
	31.0		31.1
	32.5		31.8
	33.5		32.8
Mean	32.7		32.0
Difference			0.0
SIGNIFICANCE			(n.s. .47)

data when he did raise or lower. We cannot conclude that either market or cost information is more important; our subjects seemingly chose from the data at hand that which was most consistent with their already expressed opinion.

Discussion of Results

We have witnessed a progression in the results after correction for average sale price. This can be summarized as four effects. (1) Subject Effect: When apprentice and supervisor agreed that air quality should have no effect on property values, our subjects did not give estimates of value that were significantly different from the estimates listed on the appraisal sheet. (2) Supervisor Effect: When only the supervisor felt air quality should have an effect on property values the subjects' estimates were raised but were just short of being statistically significant. (3) Combined Effect: When both men thought air quality should affect the final value estimate, so did our respondents. (4) Apprentice Effect: We had expected that when the apprentice alone thought air quality important there would be less effect on the subjects' estimates than when the supervisor alone thought air quality important; we believed there would be some tendency to accept the apprentice's judgment but not as much as there would be were his judgment supported by the supervisor. These comparisons are in Table 11. The combined opinion of the apprentice and his supervisor that air quality should affect the value of the property yields a \$1,000 difference between the polluted and the pure conditions. The supervisor's opinion alone produces almost as great a differential: \$800. When both men assert that air quality should not affect value, there remains a \$100 differ-

TABLE 11

COMPARISON OF FOUR VERSIONS OF POLLUTED VS.
PURE CONDITIONS: DOLLAR EQUIVALENTS AND
LEVELS OF SIGNIFICANCE (AFTER CORRECTION
FOR AVERAGE MARKET VALUE)

Version (Effect)	Dollar Equivalent of Difference in Mean Estimate of Value	Level of Significance
Apprentice's estimate not affected by air qual- ity, supervisor approves (Subject Effect)	\$100.00	$p = .41$
Apprentice's estimate not affected by air qual- ity, supervisor dis- approves (Supervisor Effect)	\$800.00	$p = .07$
Apprentice raises or lowers estimate and supervisor ap- proves (Combined Effect)	\$1000.00	$p = .02$
Apprentice raises or lowers estimate and supervisor disapproves (Apprentice Effect)	\$0	$p = .47$

ence in the estimates of our subjects. But when the apprentice suggests that air quality should affect the value and his supervisor overrules him, even this minimal difference disappears.

The \$100 difference we have labeled "Subject Effect" is an extremely conservative estimate of the influence of air quality on the appraised value of the property, but rigorous analysis of the design of our study will not permit unqualified support of a higher figure. The unanticipated confounding of the average market value of the three comparison houses with the polluted vs. pure conditions has been discussed in detail earlier, and we have corrected for it throughout the report. To ignore the confounding effect would yield a difference of \$1400 attributable to air quality, significant at the .02 level, but would be indefensible. If the correction factor were halved, as a compromise between statistical rigor and subjects' accounts of their estimation procedures, the difference would be \$750.00, which is statistically significant at only the .10 level. The "Subject Effect" is derived from only twelve of the 48 appraisers in the study. Unfortunately, there is no way to use the full sample as we had intended. With these restrictions, we have attained a significance level that, in this exploratory study, helps one face the question of re-design with some empirical guidance as to extent of variability and related matters.

Experimental Design Alternatives for Future Research

The industry or waste disposal that produces air pollution is likely to produce also noise, heavy traffic, and general aesthetic undesirability. The effects of these factors are usually inseparable from those of the pollution itself in a field situation. Ridker's first study, for example, did not separate them (see p. 5 above). His

second study did isolate the effect of air pollution from that of other factors but that study was dependent upon the excellent data available in St. Louis. Our use of a hypothetical property in our stimulus materials was designed to free air pollution from the factors so often associated with it.

On the other hand, there are intangible costs of air pollution to health, comfort and aesthetic satisfaction that are a direct consequence of the pollution itself, and which ought not to be neglected in any assessment of overall costs. There have been attempts to derive estimates of the cost of air pollution from estimates of the increased cost of property maintenance, but these ignore the intangible costs. Opinion surveys give substantive information on the public's evaluation of these intangibles, but do not permit translation into dollar values. The expert judgment of a professional appraiser yields a dollar value, market value estimate of the cost of air pollution. His estimate thus includes both tangible and intangible costs. It is also probable that periodic interviewing of a sample of appraisers is less costly and time-consuming than other approaches.

By embedding information on air pollution in with other positive and negative factors bearing on value, we approached the assessment in the concrete, without the pre-sensitization that would arise if a respondent is informed in advance of the intent of the study. Once the crucial information is obtained, then further probing to explore the logic of the respondent's thinking is possible.

Since appraisers make their evaluations despite the cross-pressures of sellers hoping for a high evaluation and buyers looking for a bargain, they combine professional objectivity with a sensitivity to many facets of the human evaluator's operations in setting his estimate of the value of property. It is this

special competence which makes appraisers a particularly valued source of information on the possible consequences of planned environmental changes.

To judge from the interest and cooperation shown by our respondents, it would be quite feasible to establish a nationally representative panel of practicing appraisers. Using some variant of the approach pioneered here, the fact situations could be varied to include elements relating to weather control, flood plain management, solid waste disposal, location of public housing, as well as air pollution. The results of such an approach would bring the judgment of appraisers into interaction with urban planners, public health officials, developers, architects, engineer. Sounder economic information should free the attention of planners for other questions relating to improvement in the quality of human life. Hopefully, this would improve the planning for the quality of the human environment.

Supplementary Results

Some of the information collected in the course of the investigation may be of interest in its own right, or in the design of later research. It is presented in the order that it was elicited in the questionnaire.

Apprentice's Success in Handling Selected Problems of Appraisal

Our subjects were given Card A (see Appendix A) listing seven of the variables used in evaluating the subject property, all of which had been mentioned in some detail in the apprentice's report. These are shown in Table 12. The subjects were asked which three the apprentice had handled best (Question 2.1) and which three he had handled least well (Question 2.2). If air pollution was not included in either category in their answers, the subjects were asked whether the apprentice had more or less trouble

than most apprentices in handling the remaining point (air pollution) (Question 2.3).

The results are shown below.

TABLE 12
APPRENTICE'S SUCCESS IN HANDLING SELECTED
PROBLEMS OF APPRAISAL
(frequency of mention)

VARIABLES	"Handled best"	"Handled least well"	"More trouble than most"	"Less trouble than most"
Electrical system	35	6		
Garage	26	14		
Proximity to conveniences	26	15		
Flow pattern	25	15		
Flooding	17	14		
Air pollution	11	35	1	1
Effective age	4	39		
(No response)	(0)	(6)		(0)
TOTALS	144*	144	--	--

*48 subjects, 3 responses each.

The subjects tended to approve the apprentice's handling of the electrical system, garage, proximity to conveniences, flow pattern, and flooding. They tended to disapprove his handling of air pollution and effective age. These results correspond with subjects' comments that effective age and air pollution are difficult variables to handle (see below) and with our finding that there was no significant "apprentice effect" in the subjects' corrected average estimates of sale value.

Reported Ease and Difficulty in Property Appraisal

Our subjects were asked which three of the items listed on Card A they found easiest to evaluate when making an appraisal (Question 3.1) and which three they

found most difficult to evaluate (Question 3.2). If air pollution was not included in either category, the subjects were asked whether they found the remaining item (air pollution) generally easy or difficult to handle (Question 3.3). The results are below.

TABLE 13
REPORTED EASE AND DIFFICULTY IN PROPERTY APPRAISAL
(frequency of mention)

VARIABLES	"Easiest"	"Most difficult"	"Easy"	"Difficult"
Proximity to conveniences	42	3		
Garage	18	6		
Flow pattern	30	15		
Electrical system	24	16		
Flooding	12	28		
Effective age	8	36		
Air pollution	7	36	1	3
(No response)	(3)	(4)	(1)	
TOTALS	144*	144	--	--

*48 subjects, 3 responses each.

The subjects found proximity to conveniences, garage, flow pattern, and the electrical system relatively easy to evaluate. They found air pollution, effective age, and flooding considerably more difficult.

Expert's Success in Handling Selected Problems of Appraisal

Our subjects were given Card B (see Appendix A) listing five variables mentioned in the senior appraiser's recorded critique. They were asked on which two points was the expert appraiser most justified in his comments to the apprentice (Question 5.1) and on which two was he least justified (Question 5.2). If air pollution was not included in either category, the subjects were asked whether the expert was justified to a greater or

lesser extent in his comments on the remaining point (air pollution) (Question 5.3).

The results are in Table 14, below.

TABLE 14
EXPERT'S SUCCESS IN HANDLING SELECTED
PROBLEMS OF APPRAISAL
(frequency of mention)

VARIABLES	"Most justified"	"Least justified"	Justified	
			more	less
Comparability of selection for market approach	32	9		
Construction of house	19	18		
Functional obsolescence	14	16		
Effective age	17	21		
Air pollution	12	22	2	6
(No response)	(2)	(10)	(6)	
TOTALS	96*	96	--	--

*48 subjects, 2 responses each.

A clear preponderance thought the expert justified in his comments on the comparability of the selection of properties for the market approach. This result might be interpreted as agreement with the expert's words: "On the market approach, John, you really should try to get three houses in the same area. Now I realize it's pretty difficult and can't always be done. But it would have saved you some frustration, especially in this case. But you can't always do it."

A majority thought the expert relatively less justified in his comments on air pollution. This effect is strongest when pollution is absent and the expert agrees with the apprentice, and occurs whether or not the apprentice raised the final correlated estimate because the house was not in a polluted area. This result leads us to

comment on our procedures, which may have led to more disapproving answers from our subjects than might otherwise have been the case. By asking subjects to select a set number of variables as either handled best by the apprentice or on which the expert was most justified, we allowed them leeway on only one item when we asked the next question: variables handled least well or where expert least justified. This method of eliciting opinions probably increased the likelihood that air pollution would be a focus of disagreement with the expert. In fact, we cannot conclude that any subject necessarily thought any aspect of the assignment was, in absolute terms, poorly handled: some things were simply rated less satisfactory than others in the comparative framework we created.

Main Sources of Air Pollution

Our subjects were asked, ". . . from your own experience, what are the main sources of air pollution in this area" (Question 8.3). Their free responses were coded in five categories, as shown below (with the number of appraisers in our sample of 48 who mentioned the category).

TABLE 15
MAIN SOURCES OF AIR POLLUTION
(frequency of mention)

Source of air pollution	Number of appraisers mentioning
Factories	44
Automobiles	23
Space heating	11
Quarries	2
Other	25
Total mentions	105

Forty-four of the 48 appraisers in our sample (92%) mentioned a factory, or factories generally, as the main source of air pollution in the area where they appraise. Nearly half mentioned automobiles. Most of the mentions coded "other" were sewage treatment plants or open sewers.

Types of Structure Most Affected by Air Pollution

Our subjects were asked, "In your experience, what types of structures have had their value most affected by air pollution?" (Question 8.5). Their responses are summarized below.

TABLE 16

TYPES OF STRUCTURES MOST AFFECTED BY AIR POLLUTION (frequency of mention)

Type of structure	Number of appraisers who mentioned
Single family dwellings	24
Single family dwellings and apartment houses	12
Apartment houses	2
Industrial structures	0
Commercial structures	0
Other or no response	10
Total mentions	48

In the opinion of our respondents, single family dwellings are most affected by air pollution, followed by apartments. Industrial and commercial structures are rarely affected. The relatively high incidence of "other or no response" to this question is an indication that not all subjects responded in the given categories, even when these were provided to clarify the meaning. For example, several appraisers said that "wooden structures" were most affected, and future research would need to allow for such judgments.

Importance of Air Pollution in Appraisal

Our subjects were asked, "From your experience, do you believe that air pollution today is a greater or lesser factor in real estate appraisal than it was when you began appraising?" (Question 8.61). The results are shown below.

TABLE 17

AIR POLLUTION AS A FACTOR IN APPRAISAL SINCE SUBJECT'S ENTRY INTO THE PROFESSION (frequency of mention)

Response	Number of appraisers so responding
Greater	27
Lesser	4
Other	16
(No response)	1
Total	48

Most of our subjects thought air pollution a greater factor in appraisal than it had been when they began appraising. Those who responded in the "other" category generally thought there had been little change in the importance of pollution. Great efforts have been made to clean up the air in Chicago, including closing the famous Stockyards, but only four of our respondents perceive any decrease in the importance of air pollution in appraisal.

Awareness of Air Pollution in an Apprentice

Our subjects were asked, "Do you think a young appraiser just learning his job would be as aware of air pollution as a factor affecting property values?" (Question 8.62). Some subjects asked, "As aware as whom?" and our interviewers then supplied "As aware as an experienced appraiser -- yourself, for instance." The results are shown below.

TABLE 18

WOULD AN APPRENTICE BE
AS AWARE OF AIR POLLUTION?
(frequency of mention)

Response	Number of appraisers
Yes	18
No	25
Other or no response	5
Total	48

Most subjects thought he would not be as aware of air pollution. This result probably indicates a belief that awareness of air pollution as a factor affecting property values is increased with appraisal experience. There is evidence to support this belief in our finding that the mean difference in average sale value between polluted and pure conditions was greater by \$270.00 for subjects with sixteen or more years' experience as an appraiser than for subjects with less experience.

Air Pollution as a Factor in Appraisal Ten Years Hence

Our subjects were asked whether they thought air pollution would be a greater or lesser factor in real estate appraisal ten years from now (Question 8.63). The results are below

TABLE 19

AIR POLLUTION AS A FACTOR
IN APPRAISAL TEN YEARS HENCE
(frequency of mention)

Response	Number of appraisers so responding
Greater	27
Lesser	8
Other or no response	13
Total	48

Most subjects thought air pollution will be a greater factor ten years from now. This could reflect either a belief that the pollution will be greater or a belief that awareness of air pollution as a factor will increase within the appraisal profession. Those who responded in the "other" category generally thought there would be little change.

Pollution in Area of Appraisal

Our subjects were given Card C (see Appendix A) listing degrees of air pollution and were asked, "With respect to general conditions in the Chicago area, how would you rate the quality of the air in the area where you make 50% or more of your appraisals?" (Question 8.7). The results are shown below.

TABLE 20
POLLUTION IN AREA OF APPRAISAL
(frequency of mention)

Response	Number of Appraisers
Compared to rest of Chicago area:	
Definitely more polluted	3
Quite likely more polluted	0
Probably more polluted	0
About the same as the rest of the Chicago area	10
Probably less polluted	9
Quite likely less polluted	10
Definitely less polluted	16
Total	48

Evidently 35 of our 48 subjects, selected from all over the Chicago area, thought the air less polluted in the area where they appraise than in the Chicago area generally. This is not as strange as it may seem, for an appraiser's services are more often requested in residential areas than in industrial areas, and in areas of higher structural quality than in slums. Even so, our interviewers thought that our subjects tended to

minimize air pollution in their own areas. We did not compare the results of this question directly with the degree of air pollution in the area, for the following reasons: first, several kinds of pollution are present in Chicago and their patterns of occurrence are not always similar. There is no generally accepted way of combining them into an overall pollution index. Second, about half of the appraisers in our sample did not limit their appraisals to one neighborhood, but traveled all over the city or to other cities.

How Air Pollution Affects Property Evaluation

Our subjects were given Card D (see Appendix A) listing six ways in which air pollution might affect the environment. They were asked, "Which two of these in your own experience have affected your own evaluation of property most?" (Question 8.81) and "Which two of these in your own experience affect property values least?" (Question 8.82) and "On which of these do you feel that you would like more information to use in property evaluation?" (Question 8.83). The results are shown below.

TABLE 20

HOW ASPECTS OF AIR POLLUTION AFFECT PROPERTY EVALUATION (frequency of mention)

Aspects	Affect evaluation most	Affect evaluation least	Want more information
Discoloration of paint and corrosion of metal	35	5	25
Extensive soiling	27	6	18
Visible dirt in the air	16	9	14
Visibility reduction	8	20	10
Eye irritation	5	15	10
Respiratory diseases	1	37	16
(No response)	(4)	(4)	--
Totals	96*	96	93

*48 subjects, 2 mentions each.

The aspects of pollution that tend to affect our subjects' evaluation of property most are: (1) discoloration of paint and corrosion of metal, (2) extensive soiling, and (3) visible dirt in the air. The aspects affecting value least are: (1) respiratory diseases, (2) eye irritation, and (3) reduction of visibility. The aspects about which more information is desired are, in order of frequency of mention: (1) discoloration of paint and corrosion of metal, (2) extensive soiling, (3) respiratory diseases, (4) visible dirt in the air, (5) visibility reduction, and (6) eye irritation. Six appraisers did not want information on any of the aspects, but five wanted information on all aspects.

Respiratory diseases, while not apparently seen as affecting property values, ranked third on the list about which appraisers wanted more information. Several appraisers told our interviewers that respiratory diseases are the most important aspect of air pollution, but are almost never considered at the time of a sale. Our subjects' willingness to relegate respiratory diseases to "affecting value least" is an illustration of appraisers' independence of judgment. As discussed before, they try to separate personal opinion from the factors they believe influence market values.

Relatively few of our subjects desired information on eye irritation, but this may be because in the Chicago area other aspects of air pollution are more frequent.

Meaning of Air Pollution in Chicago

Our subjects were asked, "What do you think the words 'air pollution' mean to most people in this area?" and were requested to answer "yes" or "no" to each of the categories in the table below. (Question 9.1)

TABLE 22

MEANING OF AIR POLLUTION
(frequency of mention)

Aspects	Number responding "yes"
Too much dirt and dust in the air	40
Frequent bad smells in the air	36
Frequent irritation of the eyes	27
Frequent haze or fog in the air	25
Frequent nose or throat irritation	24
Other	6

Dirt and dust in the air and bad smells are the most important perceived components of air pollution in the Chicago area, to judge from the responses given.

Relative Seriousness of Air Pollution

Our subjects were asked, "Here are a few problems which different communities are facing. How would you rate each of these problems for Chicago today?" and were asked to rate the problems below as serious, somewhat serious, or not serious. (Question 9.5) The results appear below.

TABLE 23

RELATIVE SERIOUSNESS OF AIR POLLUTION
(frequency of mention)

Problem	Serious	Somewhat serious	Not Serious	Don't know	Total
Race problems	36	8	1	3	48
Juvenile delinquency	35	9	1	3	48
Air pollution	22	17	6	3	48
Recreation areas and programs	14	18	12	4	48
Garbage and refuse collection and disposal	7	16	22	3	48
Unemployment	3	9	33	3	48

Our subjects knew that air pollution was the focus of our study before they an-

swered this question. Granting that this knowledge may have influenced their answers, it still appears that air pollution is considered a serious problem in Chicago—not as serious as race problems or juvenile delinquency, but more serious than recreation, garbage and refuse, or unemployment.

Although other questions were asked, we have reported the results of those which seemed to have the greatest interest and value.

APPENDIX A: STIMULUS CARDS

Card AQuestion 2Neighborhood

- 1) Proximity of property to conveniences.

Interior Structure

- 2) Electrical system
- 3) Flow pattern

Physical deterioration

- 4) Air pollution
- 5) Flooding

Functional obsolescence

- 6) Garage
- 7) Effective age of the house

CARD BQuestion 5

- 1) Construction of house
- 2) Effective age of house
- 3) Comparability of selection for market approach
- 4) Functional obsolescence
- 5) Air pollution

CARD CQuestion 8.7

Air in the area where you appraise compared to that in the Chicago area generally.

- 1) Definitely more polluted
- 2) Is quite likely more polluted
- 3) Probably more polluted

-
- 4) About the same as the rest of the Chicago area.
-

- 5) Probably less polluted
- 6) Quite likely less polluted.
- 7) Definitely less polluted.

CARD DQuestion 8.8

- 1) respiratory diseases
- 2) visible dirt in the air
- 3) discoloration of paint and corrosion of metal
- 4) eye irritation
- 5) extensive soiling
- 6) visibility reduction